

## Parental intention to have daughters receive the human papillomavirus vaccine

Gina S. Ogilvie MD MSc, Valencia P. Remple PhD, Fawziah Marra PharmD, Shelly A. McNeil MD, Monika Naus MD MHSc, Karen L. Pielak MSN, Thomas G. Ehlen MD, Simon R. Dobson MD, Deborah M. Money MD, David M. Patrick MD MHSc

### ABSTRACT

**Background:** Concerns have been raised that parents may be reluctant to have their daughters receive the human papillomavirus (HPV) vaccine, because of a belief that doing so might be interpreted as condoning earlier and more frequent sexual activity. We determined intentions regarding vaccination among Canadian parents and factors that predicted parental intention to have their daughters vaccinated against HPV.

**Methods:** Parents of children 8–18 years of age, recruited from across Canada, were asked to respond to questions in the context of a grade 6, publicly funded, school-based HPV vaccine program. We performed backward logistic regression analysis to identify factors predictive of parents' intention to have their daughters vaccinated against HPV.

**Results:** Of the 1350 respondents with female children, more than 70% (73.8%; 95% confidence interval [CI] 71.5%–76.1%) intended to have their daughters undergo vaccination against HPV. In multivariable modelling, parents who had positive attitudes toward vaccines (odds ratio [OR] 9.9, 95% CI 4.7–21.1), those who were influenced by subjective norms (OR 9.2, 95% CI 6.6–12.9), those who felt that the vaccine had limited influence on sexual behaviour (OR 3.2, 95% CI 2.2–4.6) and those who thought someone they knew was likely to get cervical cancer (OR 1.5, 95% CI 1.1–2.1) were more likely to intend that their daughters receive the HPV vaccine. Parents who were older (v. younger) (OR 0.6, 95% CI 0.4–0.8) and those who resided in British Columbia or Yukon Territory (v. Atlantic Canada) (OR 0.5, 95% CI 0.3–0.9) were less likely to intend that their daughters receive the HPV vaccine.

**Interpretation:** Most of the parents surveyed intended that their daughters would receive vaccination against HPV. Overall attitudes toward vaccines in general and toward the HPV vaccine in particular constituted the most significant predictor of parental intention with regard to vaccination.

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The vaccine against the human papillomavirus (HPV) represents a major step toward the prevention of cervical cancer.<sup>1,2</sup> HPV is a sexually acquired virus, and mathematical modelling and economic analyses have demonstrated that the vaccine's maximum benefit in terms of preventing cervical cancer is achieved when vaccination programs target female and possibly male adolescents before their sexual debut, likely before the age of 12 years.<sup>3</sup> The clinical efficacy and safety of the currently available HPV vaccine have been established,<sup>4</sup> but concerns have been raised that parents may be reluctant to have their children undergo vaccination at this age, because of a belief that doing so might be interpreted to mean that they are condoning or even promoting earlier and more frequent sexual activity. Since parental attitudes play a crucial role in vaccination uptake and can provide direction for messaging and education in support of vaccination uptake,<sup>5</sup> we sought to determine parental intentions to have daughters vaccinated against HPV and the factors that predict those intentions.

### Methods

#### Recruitment

Invited participants were men and women at least 19 years of age who were parents or guardians of children between 8 and 18 years of age and who could respond to questions in English or French. The participants were recruited from across Canada between June 2006 and March 2007 by random-digit dialling. Respondents were offered an opportunity to participate in a draw for a gift.

#### Development of survey tool

The survey was based on the theory of planned behaviour.<sup>6</sup> In brief, this psychological model of behaviour change parses out the elements that contribute to an actual behaviour or the most proximate measure of behaviour change, known as be-

From the University of British Columbia (Ogilvie, Remple, Marra, Naus, Ehlen, Dobson, Money, Patrick), Vancouver, BC; the Canadian Centre for Vaccinology (McNeil), Dalhousie University, Halifax, NS; the British Columbia Centre for Disease Control (Ogilvie, Naus, Pielak, Patrick), Vancouver, BC; and the Women's Health Research Institute (Money), Provincial Health Services Authority, Vancouver, BC

haviour intention. The survey tool was developed inductively, with content created through an extensive literature search exploring factors that affect vaccine-related behaviour<sup>4,7-9</sup> and through an elicitation survey of 10 parents to determine the key beliefs and attitudes related to their intention to have a child vaccinated against HPV. A focus group of 10 parents pilot-tested a draft version of the survey, providing feedback on its content, their comprehension and domains of relevance. The final survey was translated into French, and the translation was verified by having the French version back-translated into English; no significant errors were noted.

For each participant, the following demographic characteristics were assessed: age and sex of the respondent; region of residence; number of children and their sex and age; respondent's education, cultural background and religious affiliation; and household composition (e.g., 1- or 2-parent household). At the start of the survey, each participant was asked about adherence to recommended vaccination schedules for his or her children, about knowledge of cervical cancer and HPV, and about the likelihood that someone the participant knows will get cervical cancer (assessed by means of a 7-point Likert scale, where 1 = strongly disagree, 4 = neutral and 7 = strongly agree). One of several trained research interviewers then read a standardized script, providing the participant with information about HPV, the HPV vaccine, the role of HPV in cervical cancer, the nature of HPV transmission and the efficacy of the HPV vaccine. The vaccine description did not use proprietary names, was not product specific and referred to the efficacy of the vaccine against HPV related to cervical cancer and not HPV related to genital warts. The participant was next asked to respond to a series of questions in the context of a grade 6 (students 11–12 years of age), publicly funded, school-based HPV vaccination program, including a question about the intention to have his or her daughter receive the HPV vaccine. The participant was also asked about 4 specific psychological constructs that could predict an intention to vaccinate: attitudes toward vaccines in general and toward the HPV vaccine in particular, subjective norms about HPV vaccination (perceptions of others' recommendations about whether one should have a daughter undergo vaccination), perceived behavioural control over HPV vaccination (perceptions about the relative ease or difficulty of having a daughter vaccinated against HPV) and attitudes toward the influence of HPV vaccination on the sexual behaviour of adolescents. For each construct, 2–6 items were assessed by means of a 7-point Likert scale, as described earlier.

The study received ethics approval from the Behavioural Research Ethics Board at the University of British Columbia.

### Sample size

Previous studies have reported that 70% of parents intend to have their children vaccinated against HPV.<sup>7-9</sup> To generate a national estimate of parental intention with a 95% confidence interval of  $\pm 3\%$ , at least 896 participants were needed.

### Analysis

We conducted descriptive analyses of demographic characteristics. We calculated mean values for the psychological construct scales and established item reliability for the scales us-

ing Cronbach's  $\alpha$ , values of at least 0.6 indicating acceptable internal consistency. For scale items, aggregated scores were dichotomized, with a mean value of 4.5 as a cutoff and scores of 4.5 or greater indicating a generally positive value (i.e., a positive attitude, perception of behavioural control or subjective norm). We conducted bivariate analyses to compare the responses of parents who intended to have their daughters vaccinated against HPV with those of parents who did not intend to do so. For these remaining analyses, we defined intention to vaccinate as a response of 5 or greater on the Likert scale to the statement "I intend to have my daughter(s) receive the HPV vaccine (once it becomes available)." Respondents who did not agree with this statement or gave a neutral response were coded as not intending to vaccinate. We included variables that achieved  $p < 0.05$  in a multivariable model to achieve a best-fit model. We performed backward logistic regression analysis to calculate adjusted odds ratios (ORs) to identify the factors predictive of parents' intention to have their daughters vaccinated against HPV.

## Results

Between June 2006 and March 2007, calls were made to a total of 32 834 in-service telephones across Canada. Of the 23 969 homes where an answer was obtained within 4 calls, 3979 had eligible candidates, of whom 2109 (53.0%) consented to participate and 2083 completed the survey. About three-quarters of the respondents were female, and most had no more than 3 children; about half had heard of HPV but only one-quarter knew that the virus is transmitted through sexual contact (Table 1). Of the 1350 (64.8%) respondents with one or more female children, 73.8% (95% CI 71.5%–76.1%) reported that they intended to have their daughters vaccinated against HPV. In different regions of the country, the intention to vaccinate varied, from a low of 62.8% (95% CI 60.2–65.4) in British Columbia and Yukon Territory to a high of 82.6% (95% CI 80.6–84.6) in Atlantic Canada ( $p < 0.01$ ) (Table 2).

The internal reliability of the psychological constructs was acceptable (Cronbach's  $\alpha \geq 0.6$ ) for the 3 constructs and limited for perceived behavioural control (Table 3). In the bivariate analysis, we found that the intention to vaccinate was associated with age, sex and region of residence of the respondent, household composition, uptake of childhood vaccination, awareness and knowledge of HPV, belief that someone the respondent knew would get cervical cancer, overall attitudes toward vaccines and the HPV vaccine, subjective norms, perceived behavioural control of the decision to vaccinate and perceived influence of vaccination on sexual behaviour (Table 4). Cultural background, education, religious affiliation and role of religious beliefs in daily decisions were not associated with intention to vaccinate. In addition to the variables that were significant in bivariate modelling, we included the role of religion in daily decisions in the multivariable modelling, given perceptions that this variable would have an important role in decision-making related to the HPV vaccine.<sup>10,11</sup> In the multivariable modelling, we found that parents who had positive attitudes toward vaccines in general and the HPV vaccine in particular, those who were influenced by subjective norms,

those who felt that the vaccine had limited influence on sexual behaviour, those who believed that someone they knew would get cervical cancer, those who were younger, and those residing in Atlantic Canada (v. British Columbia or the Yukon Territory) were significantly more likely to intend that their daughters undergo HPV vaccination (Table 4).

## Interpretation

More than 70% of the parents of girls between the ages of 8 and 18 years who were surveyed in this national study indicated an intention to have their daughters receive the HPV

vaccine in school-based, publicly funded vaccination programs for girls 11 and 12 years of age. This estimate, although consistent with published international estimates,<sup>7,9,11-14</sup> is probably conservative, because parents who reported that they were “neutral” on the issue of having their daughters receive the vaccine were coded in our analysis as not intending to vaccinate. The strongest predictor of parental intention to vaccinate was parental attitudes toward vaccines in general and toward the HPV vaccine in particular. Recommendations in favour of HPV vaccination from health care professionals (physicians in particular), family and friends, and community leaders also constituted an important predictor of parental in-

**Table 1:** Baseline characteristics, knowledge and attitudes of study participants (*n* = 2083)

Characteristic	No. (%) of participants	Characteristic	No. (%) of participants
Age, yr		Religious affiliation	
19-29	40 (1.9)	None	414 (19.9)
30-39	619 (29.7)	Catholic Christian	684 (32.8)
40-49	1140 (54.7)	Protestant Christian	360 (17.3)
50-59	249 (12.0)	Muslim	39 (1.9)
≥ 60	18 (0.9)	Jewish	22 (1.1)
Data missing	17 (0.8)	Other	552 (26.5)
Region of residence		Data missing	12 (0.6)
British Columbia or Yukon Territory	407 (19.5)	Religion guides daily decisions	
Prairie provinces (Alberta, Saskatchewan, Manitoba), Nunavut or Northwest Territories	402 (19.3)	Disagree	504 (24.2)
Ontario	675 (32.4)	Agree	1035 (49.7)
Quebec	343 (16.5)	Data missing	544 (26.1)
Atlantic Canada	203 (9.7)	Children received childhood vaccines	
Data missing	53 (2.5)	No	14 (0.7)
Sex		Some or all	2061 (98.9)
Male	493 (23.7)	Data missing	8 (0.4)
Female	1530 (73.5)	Ever heard of HPV	
Data missing	60 (2.9)	No	971 (46.6)
Cultural background (self-identified)		Yes	1108 (53.2)
White	1738 (83.4)	Data missing	4 (0.2)
Aboriginal	47 (2.3)	Knowledge of HPV transmission	
Other	298 (14.3)	No	1520 (73.0)
Educational level		Yes	563 (27.0)
High school diploma or less	558 (26.8)	Ever received a diagnosis of cancer	
More than high school diploma	1525 (73.2)	No	1955 (93.9)
No. of children		Yes	127 (6.1)
1	891 (42.8)	Missing	1 (< 0.1)
> 1	1184 (56.8)	Know anyone who has had cancer	
Data missing	8 (0.4)	No	211 (10.1)
Household composition		Yes	1867 (89.6)
Single parent	359 (17.2)	Data missing	5 (0.2)
2 parents	1555 (74.7)	Likely that someone you know will get cancer of cervix in her lifetime	
Guardian, extended, blended	145 (7.0)	No	617 (29.6)
Data missing	24 (1.2)	Yes	1466 (70.4)

Note: HPV = human papillomavirus.

**Table 2:** Regional representation and crude estimates of parental intention to have daughters receive HPV vaccine

Region of Canada	% of sample (no.)	% of population*	Parental intention to have daughters receive HPV vaccine (95% CI)†
British Columbia or Yukon Territory	19.5 (407)	13.3	62.8 (60.2-65.4)
Prairie provinces, Nunavut or Northwest Territories	19.3 (402)	17.0	77.4 (75.2-79.6)
Ontario	32.4 (675)	38.9	75.3 (73.0-77.6)
Quebec	16.5 (343)	23.5	77.5 (75.3-79.7)
Atlantic Canada	9.7 (203)	7.3	82.6 (80.6-84.6)
Overall			73.8 (71.5-76.1)

Note: HPV = human papillomavirus, CI = confidence interval.

\*According to data from Statistics Canada for 2005.<sup>17</sup>

†Estimates and 95% CIs are based on responses from the 1350 participants who had female offspring.

**Table 3:** Results of psychological construct scales

Attitude or norm	Mean score* (SD)	Cronbach's $\alpha$ †
Attitudes toward vaccines in general and the HPV vaccine in particular (n = 2021)		
Childhood vaccines are beneficial	6.2 (1.1)	
HPV vaccine is beneficial for girls	6.0 (1.3)	
HPV vaccine is beneficial for boys	5.8 (1.4)	
Cervical cancer is a serious illness	6.7 (0.7)	
HPV vaccine is effective in preventing cervical cancer	5.4 (1.2)	
HPV vaccine is safe	4.6 (1.1)	
Overall	5.8 (0.8)	0.8
Subjective norms (n = 1546)		
Physician's recommendation to vaccinate is influential	6.2 (1.4)	
Public health nurse's recommendation to vaccinate is influential	5.7 (1.6)	
Recommendations of friends or family to vaccinate are influential	4.8 (1.7)	
Teacher's or principal's recommendation to vaccinate is influential	4.6 (1.7)	
Spiritual leader's recommendation to vaccinate is influential	4.1 (1.9)	
Overall	5.1 (1.4)	0.9
Direct perceived behavioural control (n = 2072)		
Respondent is confident that he or she could have children receive vaccine	6.0 (1.1)	
Decision to have child undergo vaccination is within parent's control	5.8 (1.7)	
Overall	5.9 (1.1)	0.3
Attitudes toward influence of HPV vaccine on sexual behaviour (n = 2062)		
Important that children be vaccinated against HPV before sexual debut	5.9 (1.4)	
HPV vaccine will not make children sexually active at an earlier age	5.8 (1.6)	
Adolescents who receive the HPV vaccine will not be encouraged to engage in unsafe sex	5.5 (1.7)	
Adolescents who receive HPV vaccine will not have a higher number of sexual partners	5.7 (1.5)	
Adolescents who practise safe sex will avoid HPV acquisition	4.2 (1.9)	
Overall	5.4 (1.0)	0.6

Note: HPV = human papillomavirus, SD = standard deviation.

\*Responses relate to a 7-point Likert scale.

†Item reliability for the psychological construct scales was established by means of Cronbach's  $\alpha$ , where a value of at least 0.6 indicates acceptable internal consistency.

tention to vaccinate. In contrast, cultural background, education, religious affiliation and role of religious beliefs in daily decisions, all of which might be expected to influence such decisions, were not associated with parental intention to vaccinate.

Just over 20% of the parents of girls (285/1350) expressed concerns about the influence of the HPV vaccine on sexual behaviour. Along with parental age, such concerns represented a significant predictor of the intention to vaccinate. This finding may be related to different attitudes among younger versus older parents regarding the implications of sexual health initiatives on the sexual behaviours of youth. Parents need reassurance that sexual health initiatives and receipt of a vaccine for a sexually acquired virus that causes cancer is unlikely to promote unsafe sexual activity.<sup>15,16</sup>

Intention to vaccinate varies by region, from about 63% in British Columbia or the Yukon Territory to over 80% in Atlantic Canada (Table 2).<sup>17</sup> Regional variations in vaccination rates are not unusual,<sup>18,19</sup> although childhood vaccination rates in British Columbia are comparable to those in other provinces where such assessments are conducted. These findings could be due in part to the dynamic backdrop of the marketing of the HPV vaccine Gardasil (Merck) in North America in the past year.<sup>20</sup> However, our analysis did not reveal any significant difference in intention to vaccinate with the HPV vaccine between parents recruited in the first half of the study and those recruited in the latter half (data not shown), and knowledge of HPV was included in the multivariable modelling. Further assessment is required to understand the reasons underpinning the difference in parental at-

**Table 4:** Bivariate and multivariable analysis of predictors of intention to have daughters receive the HPV vaccine (part 1)

Characteristic	No. (%) with intention to vaccinate	Unadjusted odds ratio (95% CI)	Adjusted odds ratio* (95% CI) <i>n</i> = 1269
Age, yr	<i>n</i> = 1341		
≤ 39	339 (80.3)	1.0	1.0
> 40	652 (70.9)	0.6 (0.5-0.8)†	0.6 (0.4-0.8)
Region of residence	<i>n</i> = 1324		
British Columbia or Yukon Territory	169 (62.8)	0.4 (0.2-0.6)†	0.5 (0.3-0.9)
Prairie provinces, Nunavut or Northwest Territories	205 (77.4)	0.7 (0.4-1.2)	1.5 (0.8-2.8)
Ontario	324 (75.3)	0.6 (0.4-1.0)	1.3 (0.7-2.3)
Quebec	172 (77.5)	0.7 (0.4-1.2)	1.6 (0.8-3.1)
Atlantic Canada	114 (82.6)	1.0	1.0
Sex	<i>n</i> = 1308		
Male	299 (68.6)	1.0	
Female	759 (75.2)	1.4 (1.0-1.8)†	
Cultural background	<i>n</i> = 1350		
White	845 (74.4)	1.0	
Aboriginal	23 (79.3)	1.3 (0.5-3.3)	
Other	128 (68.8)	0.8 (0.5-1.1)	
Education level	<i>n</i> = 1350		
High school diploma or less	265 (76.8)	1.0	
More than high school diploma	731 (72.7)	0.8 (0.6-1.0)	
No. of children	<i>n</i> = 1344		
1	334 (75.6)	1.0	
> 1	660 (73.2)	0.9 (0.7-1.1)	
Household composition	<i>n</i> = 1338		
2 parents	741 (72.5)	1.0	
Not 2 parents	250 (79.1)	1.4 (1.1-1.9)†	
Religious affiliation	<i>n</i> = 1350		
None	196 (75.4)	1.0	
Any	800 (73.4)	0.9 (0.7-1.2)	
Religion guides daily decisions	<i>n</i> = 1350		
Disagree	509 (74.9)	1.0	
Agree	487 (72.7)	0.9 (0.7-1.1)	

titudes toward the HPV vaccine in British Columbia and the Yukon Territory compared with Atlantic Canada.

There were some limitations to our study. We used a random-digit dialling method, which can result in a recruitment bias toward more educated individuals<sup>21</sup> and may under-recruit participants from rural or remote regions. In addition, the response rate (about 55%) was slightly less than that reported by others; however, given the large sample size in our study, this likely does not represent a threat to the validity of the findings. The internal consistency of one scale item, perceived behavioural control, was poor (Cronbach's  $\alpha = 0.3$ ) (Table 3). However, this scale just achieved significance in the bivariate analysis and was not significant in the multivariable modelling. In contrast, the scales that were highly significant in the multivariable modelling were also highly internally con-

sistent. In addition, there was overrepresentation of respondents from some regions (Atlantic Canada, Prairie provinces, and British Columbia or the Yukon Territory) and underrepresentation of respondents from the other regions, relative to their representation in the national population (Table 2). Regardless, given the relatively narrow confidence intervals for the estimates of intended vaccination uptake in these regions, our study provides precise estimates of intended vaccination rates in these areas. Despite these limitations, our findings are consistent with existing international literature, including our observation that most parents intend to have their daughters receive the HPV vaccine<sup>13</sup> and our findings as to key predictors of intention to vaccinate.<sup>11,12,14,22,23</sup>

The HPV vaccine is an important element in efforts to prevent cervical cancer in Canada. Recent funding announce-

**Table 4:** Bivariate and multivariable analysis of predictors of intention to have daughters receive the HPV vaccine (part 2)

Characteristic	No. (%) with intention to vaccinate	Unadjusted odds ratio (95% CI)	Adjusted odds ratio* (95% CI) <i>n</i> = 1269
Children have received childhood vaccines	<i>n</i> = 1344		
No	1 (9.1)	1.0	
Some or all	992 (74.4)	29.0 (3.7-228.0)†	
Ever heard of HPV	<i>n</i> = 1348		
No	420 (69.4)	1.0	
Yes	575 (77.4)	1.5 (1.2-1.9)†	
Knowledge of HPV transmission	<i>n</i> = 1350		
No	699 (71.7)	1.0	
Yes	297 (79.2)	1.5 (1.1-2.0)†	
Ever received a diagnosis of cancer	<i>n</i> = 1350		
No	936 (73.5)	1.0	
Yes	60 (77.9)	1.3 (0.7-2.2)	
Know anyone who has had cancer	<i>n</i> = 1348		
No	92 (71.9)	1.0	
Yes	903 (74.0)	1.1 (0.7-1.7)	
Likely that someone you know will get cancer of cervix	<i>n</i> = 1350		
No	264 (64.7)	1.0	1.0
Yes	732 (77.7)	1.9 (1.5-2.5)†	1.5 (1.1-2.1)
Attitudes toward vaccines and HPV vaccine	<i>n</i> = 1350		
Negative	10 (10.1)	1.0	1.0
Positive	986 (78.8)	33.2 (17.0-64.6)†	9.9 (4.7-21.1)
Subjective norms	<i>n</i> = 1349		
Not influential	162 (39.7)	1.0	1.0
Influential	833 (88.5)	11.7 (8.8-15.5)†	9.2 (6.6-12.9)
Perceived behavioural control	<i>n</i> = 1349		
Not able to control	145 (66.2)	1.0	
Able to control	850 (75.2)	1.6 (1.1-2.1)†	
Perceived influence of vaccine on sexual behaviour	<i>n</i> = 1350		
Negative influence	144 (50.5)	1.0	1.0
Limited influence	852 (80.0)	3.9 (3.0-5.2)†	3.2 (2.2-4.6)

Note: HPV = human papillomavirus, CI = confidence interval.

\*Adjusted for variables that were significant in bivariate analyses and for the role of religion in daily decisions.

†*p* < 0.05.

ments by the federal government<sup>24</sup> and announcements of HPV vaccine programs by the Ontario<sup>25</sup> and Nova Scotia<sup>26</sup> governments underscore the need to expeditiously define key contributors to optimal HPV vaccine uptake in Canada. In this national survey, we found that the majority of responding parents would have their daughters vaccinated against HPV in the context of a publicly funded, school-based program offered in grade 6. Specific parental characteristics were associated with the intention to not have daughters vaccinated. Health policy-makers and practitioners should ensure that planning for HPV vaccine implementation addresses these issues to ensure optimal uptake of this efficacious vaccine.

This article has been peer reviewed.

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**Contributors:** The study was conceived by all of the authors. Study design was led by Gina Ogilvie and Valencia Remple, with assistance from the other authors. Gina Ogilvie and Valencia Remple supervised the study and conducted the data analysis. The manuscript was prepared by Gina Ogilvie with assistance from Valencia Remple. All of the authors revised the manuscript and approved the final version of the submitted publication.

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**Correspondence to:** Dr. Gina S. Ogilvie, Associate Director, Division of STI/HIV Prevention and Control, BC Centre for Disease Control, 655 West 12th Ave., Vancouver BC V5Z 4R4; fax 604 775-0808; [gina.ogilvie@bccdc.ca](mailto:gina.ogilvie@bccdc.ca)

For a series of articles that examine the consequences of human papillomavirus (HPV) and the efficacy of HPV vaccines, see the August 28 issue of *CMAJ* (available at [www.cmaj.ca](http://www.cmaj.ca)). A series of letters on this subject may be found on page 1524 in the current issue.